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AUTHOR Gunn, Cathy
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ABSTRACT

A survey of literature indicates that gender differences in computer use and attitude exist. In the public school system, girls are shortchanged, especially in the areas of math, science, and technology. Instructors need to be made aware of these differences and their actions and attitudes should promote sex equity. This paper begins with an overview of development of gender roles, particularly in classrooms that use technology. Following, observations of classroom use of technology that might affect gender equity are described in three scenarios for grades 2, 5, and 6. Strategies are then presented for encouraging more computer use by girls. Teacher role, appropriate computer use in classrooms, and selection of software are discussed. (Contains 13 references.) (AEF)

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Development of Gender Roles: Technology as an Equity Strategy

Cathy Gunn, Ph.D.
Center for Excellence in Education
Box 5774
Northern Arizona University
Flagstaff, AZ 86011-5774
(602) 523-9507
gunn@nauvax.ucc.nau.edu

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Abstract

Gender differences in computer use and attitude still exist in our classrooms. Discussion through scenarios centers on characteristics that differentiate girls from boys, development of gender roles, and factors that might be contributing to gender differences in computer use in our elementary classrooms. Intervention strategies for addressing gender differences in computer use and attitude are suggested.

Introduction

Goal Four of the National Education Goals (National Governors Association, 1990) states that "by the year 2000, U.S. students will be first in the world in science and mathematics achievement." If the United States is to remain competitive in world markets, the nation must have a technologically competent work force. American democracy cannot flourish in the twenty-first century without a scientifically literate citizenry. Thus, the achievement and participation of girls—and of boys—

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from all racial and ethnic groups is a topic of considerable importance to policy-makers in business and industry as well as education. Girls, however, are steered away from the very courses required for their productive participation in the future of America. Their participation requires strength in science, mathematics, and technology—subjects girls are still being told are not suitable for them.

A survey of literature indicates that in general, teachers and schools are not yet integrating newer computer applications into the curriculum, and that gender differences in computer use and attitude exist (Thompson, Simonson, & Hargrave, 1992; Whiteside, 1992; Kiesler, Sproull, & Eccles, 1983). Reports surveyed indicate (AAUW, 1992; Thompson, Simonson & Hargrave, 1992) that girls are shortchanged in the public school system, especially in the areas of math, science, and technology and that sex and gender equity issues are still not well understood by many educators. Thompson, Simonson and Hargrave (1992) suggest that educators develop and examine interventions designed to encourage females to use technology and develop positive attitudes. These researchers also suggest that in-service training on equity issues can both increase awareness and provide specific tools for achieving a more equitable educational environment. The National Coalition for Women and Girls in Education (AAUW, 1992) has repeatedly noted that the National Education Goals cannot be met without specific attention to girls, and they have stated educators' attention must be directed to those characteristics that differentiate girls from boys. Kay (1992) argues for a qualitative, contextual, developmental approach to acquire a more precise understanding of how behaviors associated with computer attitude, aptitude, and use emerge.

This paper begins with an overview of development of gender roles, particularly in classrooms that use technology. Following this overview, observations of classroom use of technology that might effect gender equity are provided for context and discussion through scenarios. Strategies are put forth for providing an overall, positive environment for young women and young men. This paper is hopefully a means to provide thought provoking questions and continued discussion on equity issues.

Development of Gender Roles

Our society holds different expectations for girls and boys; these expectations, depending upon sex however, generate different patterns of behavior in children. Johnson and Swoope (1987) indicate that boys and girls in grades 1, 3, 5, 7, 9, and 12 showed considerable interest in computers. What factors, then, affect that interest to the point that girls don't choose to use computers as often, or as much as boys?

A study by the National Coalition for Women and Girls in Education (AAUW, 1992) indicates boys more consistently choose and prefer sex-typed toys and activities. In addition, this report finds these preferences accelerate with age throughout early childhood. By the time children are six or seven years of age, they have developed clear ideas about gender. These attitudes are based on what they see in their world. Girls and boys, then, strive to conform with gender-stereotyped roles. As a result, both sexes strongly prefer sex-segregated play groups at this age.

In the same study (AAUW, 1992), it is reported children aged eight to ten are more flexible regarding occupational roles for women and men than their younger counterparts, and there is some reduction of sex-segregated behavior. Most children of this age continue to prefer to spend time with same-sex friends.

AAUW reports (1992) that in early adolescence, more rigid adherence to gender roles becomes the norm. Early adolescence is a significant transition period for both sexes, but adolescence is a particularly difficult time for girls. At age 11 or 12, physical differences between boys and girls are particularly apparent. Large-scale empirical studies, public-opinion polls, and in-depth clinical studies following individual girls through school all report significant declines in girls' self-esteem and self-confidence as they move from childhood to early adolescence. This decline in self-esteem and self-confidence is found in the physical sciences—one critical area in which girls continue to trail behind boys. Even girls who take the same mathematics and science courses as boys and perform equally well on tests are much less apt to pursue scientific or technological careers than their male classmates. These same girls, when asked about their performance in math and science, state that they "can't do math," or that they don't understand math and science.

Why do some girls lose confidence in their abilities while so often continuing to receive high grades? "Girls learn to view their successes as caused by luck and their failures as due to lack of ability; boys learn to attribute their successes to ability and their failures to bad breaks" (Kerr, 1991, p. 128). Dweck & Gilliard (1975) discovered most teacher feedback to boys was negative and focused mainly on conduct and social behavior. Lack of effort is the usual criticism for boys; teachers consistently tell boys that they are not trying hard enough. Kerr writes that teachers' feedback to girls most often is positive, and seldom refers to effort. When girls fail at a task, teachers seldom tell them they are not trying hard enough. Thus, says Kerr, "girls do not learn to associate their effort with either failure or success. Boys learn from being told to 'try harder,' that they have control over the results of their work" (p. 128). In a conference report of this study, Kerr stated that asking a boy with a grade average of C in math how he is doing will often result in the answer "I'm doing good." Furthermore, Kerr states,

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asking the same question of a young women of the same age and with the same grade average, will most often result in the answer that she is not doing well or "can't do math." This is a gender gap our schools can no longer afford to ignore.

Classroom Observations

The following classroom scenarios are a composite of episodes observed by this writer in a number of classrooms in a wide variety of school settings. While these classrooms are fictitious in their reporting, observations were informal and not part of any organized research study. These scenarios described are representative of real occurrences that might contribute to technology gender inequity. They are presented here to provide context for discussions on classroom uses of technology and gender issues.

Scenario 1—Grade Two

Ms. Lewis teaches second grade—seven and eight-year olds—and has one computer in her classroom. She has this computer connected to a large screen television monitor and placed in a prominent place in the classroom as part of the large group reading circle. After reading the story Quick as a Cricket by Audrey and Don Wood, Ms. Lewis begins a discussion with her second-graders. The discussion centers around the use of descriptive words in stories, while at the same time, talking about the similes used in this book.

During the discussion, Ms. Lewis goes to the computer loaded with a word processor. She asks each student to tell her a sentence using a simile pattern, which she writes with each person's name ("I'm as __ as a __," Said __.). The similes are printed on a separate page for students to illustrate; they are then combined into a class book on similes, which will be put into their class library. While she writes each child's simile, Ms. Lewis orally describes how she uses the word processor to make changes (i.e., inserting words, saving document). At the completion of this activity, Ms. Lewis encourages Jerry to continue writing his story about his pets at the computer. The rest of the class continues writing stories from their writing folders with paper and pencil. Later, Ms. Lewis introduces a lesson on mammals. Susan and Maria are given the opportunity to use the CD-ROM in the library to find information on mammals. Children also see Ms. Lewis use the word processor to write a weekly newsletter for parents.

Throughout the rest of the week, Ann, Mario, and Felicia are assigned specific time throughout the day to use the computer to write reports on their research of mammals. Jarrod, Mary and Kris have computers at home and are encouraged to finish their reports at home using a word processor. The rest of the class will write their reports with paper and pencil. Ms. Lewis loads a word processor into the computer each morning and uses it almost exclusively during writing each day. She uses a schedule for writing at the computer, therefore, every child has a respective assigned time throughout the week to use the computer. Students with computers at home are encouraged to make use of home computers for writing. Ms. Lewis compensates that home use by varying other assignments so students are not overburdened with extra homework. For example, if Jarrod, Mary and Kris are working on their mammal report at home, they are able to use class time to work on other projects or assignments that might go home with other students.

Scenario 2—Grade Five

Mr. Rodriegez's fifth-grade class has a specific 40 minutes set aside each week to use the computer lab. These early adolescent students are able to choose any software from the wide-ranging software library available to them. A number of fifth grade boys rush into the lab ahead of their class to grab their favorite programs and to claim their computers. An observer would notice this group usually chooses the same programs while sitting at the same computers week after week. The typical program used by this group usually involves engaging graphics, a skill activity that involves manual dexterity, such as "shooting" letters from space or animals moving across the screen, or a program that has a Star Wars-type theme. They also choose to work together, sometimes in groups of four and five. They seem to enjoy this time at the computers. They are often loud and boisterous in their interaction together and with the programs they are using. The boys are usually fun-loving in spirit. There is an inordinate amount of sharing—conversations and information related to programs—between computers. As the rest of the class file into the lab, girls, usually in pairs or small groups, move quietly to shelves of software and spend time looking at title. In contrast to the boys entrance into the room, these girls continue conversations begun on the way to the lab. Eventually, most female student groups will get to a computer, begin a program, and continue their conversations. Their interaction is much quieter than the larger groups of boys, and the girls spend more of their time talking and giggling than they do on interacting with the computer.

Mr. Rodriegez has one computer in his classroom, but in contrast to Ms. Lewis's use of this sole computer, it is most often used similarly to the computer lab. Whenever anyone finishes their work, they can choose to use the computer and the limited number of games that are stored with the computer during free time. Groups are self-selected and Mr. Rodriegez does not direct software selection. Mr. Rodriegez uses the computer himself for grade-keeping tasks and occasional correspondence or student worksheets. This use is often relegated to free periods or before- and after-school hours.

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Scenario 3—Grade Six

Mr. Berndt's sixth-grade science class is working on an environmental project in which students have chosen their own cooperative learning groups. Each group of early adolescents selected an area of environmental study to research in their own community. The criteria selected for completing the project include collecting data and using technology in some way to either analyze the data or to present findings. One group has chosen to photograph recycling efforts in their community, using a still camera to digitize photos. Another group will use *HyperCard* to create an informational program on an environmental topic. A third group has chosen to videotape interviews of community citizens.

Scenario 1 Discussion

Each of the above scenarios provide context for gender equity and technology discussions which follow. Children in second, third and fourth grades, approximately ages seven through ten, were reported as having already developed ideas of gender roles based on what they see in their world (AAUW, 1992). They also preferred sex-segregated play groups in the earlier years. Some reduction of sex-segregated behaviors existed, but children in the AAUW report still preferred to spend time with same-sex friends. Ms. Lewis' classroom, as described above in the first scenario, may provide a model for technology use for this age group. Here, the computer is used often as a writing tool and with frequent modeling by the teacher. Ms. Lewis' students see a female adult writing, and are aware of the benefits of using a word processor for the writing process. They see their teacher using the computer as a tool for her own work. Because Ms. Lewis is aware of who is using the computer in the classroom and at home, she is able to guarantee computer use for each of her students. The computer use is also directed in a way that fits the needs of all her students, male and female, a recommendation reported by Sanders in her Computer Equity Training Project (1985). Boys often see the computer used as a writing tool, one in which the writing process is demonstrated.

It is important that educators test the theory that using language arts-directed software at this age of interest may support both male and female student use of technology as a tool, and that such technological implementation promotes female interest in the technology field. Girls seem to be as interested in using the computer as boys, and that interest is supported by the choice of software and the time and reasons for using the computer. Do girls like writing at a computer as compared to game playing at this age? Does the modeling provided by a teacher using the computer for writing help both boys and girls develop positive attitudes towards females using technology? Would writing across content areas with six to ten year olds, especially in the math and sciences, increase girls' use of technology in later years?

Scenario 2 Discussion

In the second classroom, Mr. Rodriegez has not addressed the gender issue of computer use, and may in fact perpetuate females' choices to not use the computer. Information from the AAUW report (1992) detailed earlier tells us that early adolescence is a significant transition period for both sexes, and a particularly difficult time for girls. AAUW have reported significant declines in girls' self-esteem and self-confidence at this age. Students, when given free choice in software selection and groupings, will probably choose according to stereotypical, sex-segregated behaviors that they think are expected of them. Students will probably choose same-sex partners. "Fairly distinctive styles of interaction develop in all-boy and all-girl groups...the distinctive patterns developed by the two sexes at this time have implications for the same-sex and cross-sex relationships that individuals form as they enter adolescence and adulthood" (Maccoby, 1990).

There are several possible interventions that require testing in Mr. Rodriegez's and other fourth- through sixth-grade classrooms. Teachers of this age level may wish to consider asking students their perceptions about stereotypical, sex-segregated behaviors. Are women seen by this age student as having designated occupations and behaviors? Do these young men and women feel they are expected to adopt particular sex-stereotypical behaviors? This age student might well benefit from classroom presentations and associations with women and men in non-typical, as well as typical, roles (especially in technology-related fields), with roles and expectations made explicit. Should teachers of fourth- through sixth-grade students give opportunities for both teacher and self-selected grouping (i.e., cooperative learning groups selected according to abilities and/or interests versus students choosing friends)? Through self-selection, girls and boys alike may be more comfortable, but teacher-selected grouping with teacher guidance may help both genders practice this cross-grouping. One area that deserves study is software selection; should teachers select all software at these grade levels for gender appropriateness? And what is gender appropriateness? What are some of the means to determine appropriate gender differentiation? What kind of feedback do we give all our students, both male and female?

Scenario 3 Discussion

Students in Mr. Berndt's sixth-grade have been given a number of choices—who they will work with, what area of this study they will pursue, and what technology they will use to report their findings. Hopefully, these young people will see modeling of technology as a tool in those earlier developmental ages when they are more flexible regarding occupational roles for men and women, and can now make appropriate choices regarding technology use and attitude. While it is important that cooperative learning groups are determined by their teacher for many activities, perhaps it is just as important

that students also choose their own groups for comfort (Sanders, 1985). Girls "do" science, math and technology equally as well as boys, and at this age it is imperative that we let both girls and boys know explicitly how they are doing. Questions for study at this developmental stage include: Are we providing role models for young women in the math, science and technology fields? What kind of feedback do we give young men and women, and does it differ between the sexes? Are we as critical of girls as we are of boys? Have we been open with students of this age as to gender inequity and their obligations as contributing members of their society as science, math and technology play greater roles?

Questions have been raised in this section for educators to discuss, pursue, and to include in research agendas. It is imperative that teachers play a prominent role as researchers as we investigate gender roles in technology use.

Interventions

Mentoring

How is it suggested that we help girls aim higher? A program at Johns Hopkins University was developed to change junior high girls' attitudes and course-taking behaviors toward careers in science and mathematics (Kerr, 1991). Normally, girls drop out of math courses early in their education. The program stressed small group and individualized instruction, and cooperative rather than competitive activities. Since girls generally focus on social careers, teachers emphasized the way in which mathematics could be used to solve social problems. Girls were encouraged to view themselves as competent in mathematics, and to overcome any "math anxiety." The program was successful in initially challenging the girls to higher achievement in math, although career interests in math dropped off. Other programs across the country offer counseling and career guidance for young women to look towards the science, mathematics, and technology fields.

Awareness

The characteristics of gender role development found in young girls to early adolescence and described above are critical in the development of technology curriculum/use in the elementary school environment. Educators need to be aware that there is a gender gap in the science, math, and technology areas. Teachers are not always aware of the ways in which they interact with students. Observations in classroom use of technology are critical. Videotaping actual classrooms so that teachers can see themselves in action can help them to develop their own strategies for fostering gender-equitable education. The use of equitable teaching strategies should be one of the criteria by which teaching performance is evaluated.

Appropriate Classroom Use

It seems that one computer classrooms in which the computer is used for rewards for finished work or game-playing can widen the gender equity gap. This author has observed middle-grade girls find ways to avoid being the first student done with an assignment so they wouldn't have to use the computer as a reward. This seems especially true if there is a game available to play that includes arcade-style graphics and "shoot-em-up" activities. Traditionally, in classrooms observed by this writer, it is often a boy who uses a computer at home, widening the gap of the "haves" and the "have nots," as well as gender inequity. Whiteside (1992) suggests two good reasons for using classroom computers for practical, goal-oriented purposes. One is that girls seem to prefer using a computer as a means to an end, while boys appear to enjoy using it as an end to itself. To encourage greater computer use by girls, therefore, we should stress school-related computer uses such as word processing, database programs, graphics and telecommunications. The second reason is that these are school computers, which presumably ought to be used for educational goals. Many children have other opportunities outside the classroom for shoot-'em-up games.

Girls and boys need to be guided in their use of technology. All children should have access to technology under conditions that suit their learning and self-awareness. Teachers may need to reexamine both the style with which they relate to girls, and the particular content areas that are emphasized when dealing with each sex. Computer use needs to be directed by teachers to provide the best learning environment: do the software programs chosen for classroom use support learning objectives? Are all children provided equal opportunities for using the computer? Are groups often teacher-selected to provide a mix of students to practice social skills, peer tutoring, and cooperative learning? If the computer is used for activities throughout the day, it is a teacher's responsibility to manage grouping and objectives for using the computer. Relating computer use to concepts already studied in class, using the computer for writing across the curriculum, and modeling of technology by the teacher as a tool are all ways of providing guidance to girls' use of technology.

Selection of Software

A question to be studied by educators interested in righting the disparity between male and female student use of computers is whether the software programs used by our students are appropriate. The following sex equity studies indicate the need for teachers to review computer programs. A study by Johnson and Swoope (1987) indicates that there is a marked difference in interest patterns when content of a computer game uses a video game format, depicted as masculine rather than feminine by students. This interpretation supports Malone's findings (1981) that girls showed little interest in using

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educational software materials modeled after more masculine-oriented video-arcade games. When given access to more neutral materials that did not involve shooting and war-game response formats, girls' use of, and interest in, materials increased substantially.

If girls' interest in computers is to be maintained and encouraged, the examination of software for possible sex bias should be an important consideration in software selection. Whiteside (1992, p. 254) suggests the use of a software evaluation checklist which includes the sex equity criteria: sex-fairness of activities, sex fairness of interaction (balanced versus only highly competitive), and non-sexist approach provided in the context. What we really want is to create an environment in which any student, male or female, feels free to explore his or her interests without being influenced by "stereotypical notions of 'girls' activities' and 'boys' activities" (Brady & Slesnick, 1985).

Our classroom environment must support an openness to gender differences. The traditional idea that girls are better in verbal areas while boys excel in quantitative skills is less true today. Data indicate a narrowing of sex differences in tested achievement on a variety of measures (1992, AAUW). AAUW reports, however, that a narrowing of differences is not an absence of differences—important insights can be gained by looking carefully at the continuing gender gaps in educational achievement and participation. It is important for educators to study this data further and to test in our own classrooms.

In-service and Pre-service Implications

Perhaps introducing technology to the very young, before girls identify the computer as a tool for boys, may move our young women closer to technology. The key to computer equity success in a school seems to be the willingness of the faculty to take active steps toward encouraging girls' computer use. They need to feel that computer use is valuable in and of itself, and to feel that a focus on girls is important and legitimate.

Integrating sex equity concepts into educational technology pre-service and in-service courses and workshops are necessary. Instructors' attitudes and actions in and out of the classroom must promote sex equity, as models for students' attitudes and actions in and out of the classroom. Whiteside (1992) suggests that teacher educators need to become aware of sex equity research, develop sex equity course objectives, identify sex equity course content, model appropriate sex equity teaching strategies, and provide sex equity evaluation procedures and practice. Changing attitudes cannot be accomplished through a book; face-to-face contact and interchange in a training environment are essential (Sanders, 1985).

Conclusion

Addressing sex equity requires first an awareness that we aren't meeting the needs of our young women as they prepare to become leaders in a technologically competent nation competitive in world markets. This paper has presented a review of literature addressing sex equity issues, a discussion on characteristics that differentiate girls from boys, development of gender roles, and intervention strategies for addressing gender differences in computer use and attitude. Many teachers, however, are providing modeling and equal opportunities for technology use to the girls in their classrooms. It is critical that we look for these learning environments, study and develop effective intervention strategies and then include them in teacher preparation and in-service programs.

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